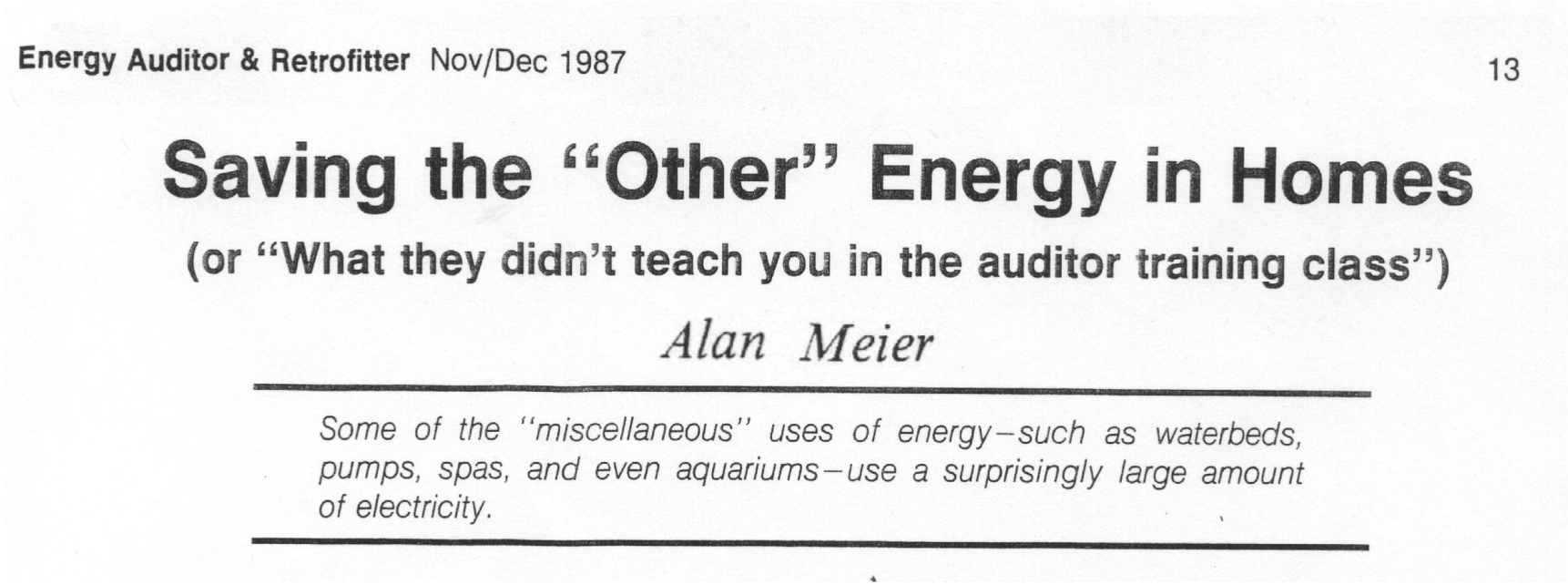
Saving the "Other" Energy in Homes

Addressing the Critical ZEH Performance Gap

Lawrence Berkeley National Laboratory

Rich Brown & Alan Meier



Energy Auditor & Retrofitter Nov/Dec 1987

Saving the "Other" Energy in Homes

(or "What they didn't teach you in the auditor training class")

Alan Meier

Some of the "miscellaneous" uses of energy—such as waterbeds, pumps, spas, and even aquariums—use a surprisingly large amount of electricity.

- MELs research ongoing for 20+ years
- Our understanding has improved in that time
- But MELs are an elusive target

Plan

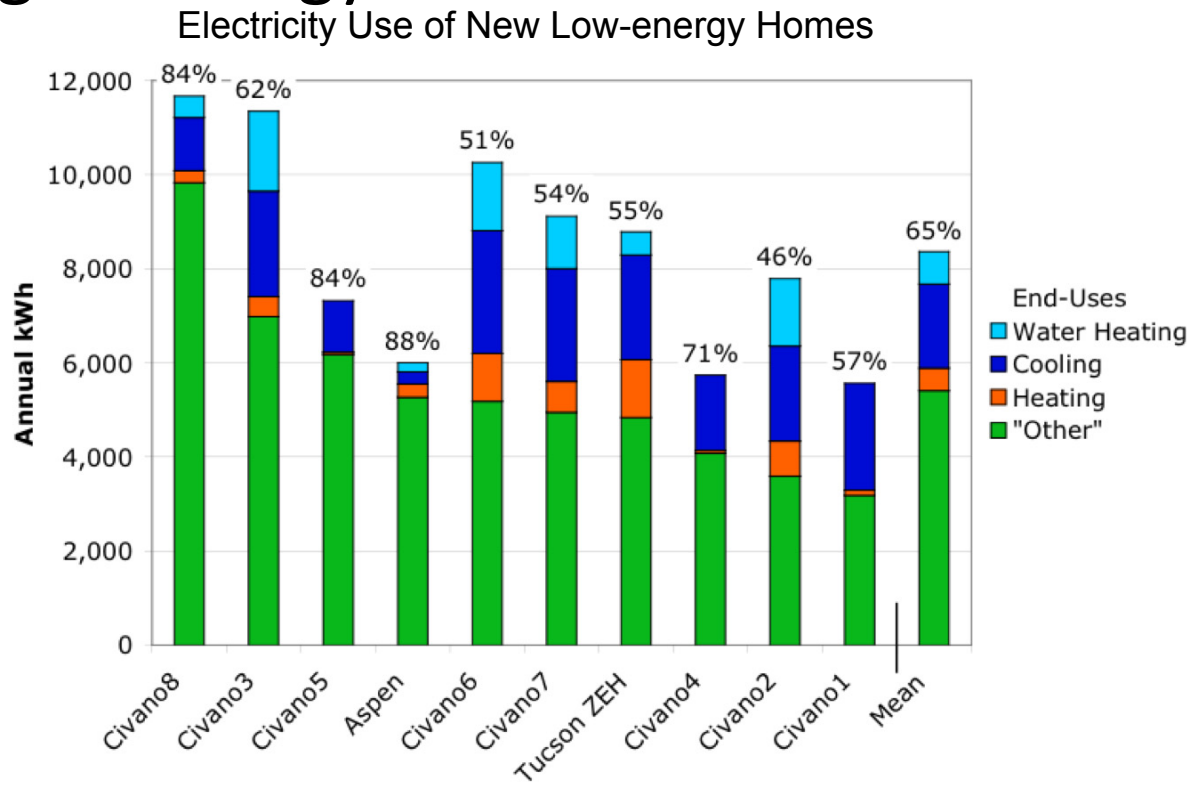
- Background
- Goals & Methodology
- Initial Plans & Experience
- Links to Other Work
- Discussion

What are MELs?

- No clear definition (or, definition by exclusion)
- Often treated as the "residual" after removing primary hvac, refrigeration, water heating, etc.
- Includes products that:
  - Have low energy use but ubiquitous
  - Have moderate energy use but present in small fraction of homes
- MELs ≠ standby power
- "MELs" should mean "Miscellaneous and *Electronic* Loads"

Background

- MELs now often largest consumption in zero-energy homes
- Fastest growing end-use in buildings
- No single strategy to cut MELs



Background

- MELs are a fundamentally different "target" than conventional end uses:
  - Definition (definition by exclusion)
  - Diversity and diffusion (many devices of many types)
  - Metering (old ways don't work when device moves)
  - Reducing (if they are so hard to meter, then imagine how difficult they will be to control!)
  - Regulation (hard to regulate; devices can evolve quickly both in function and technology)

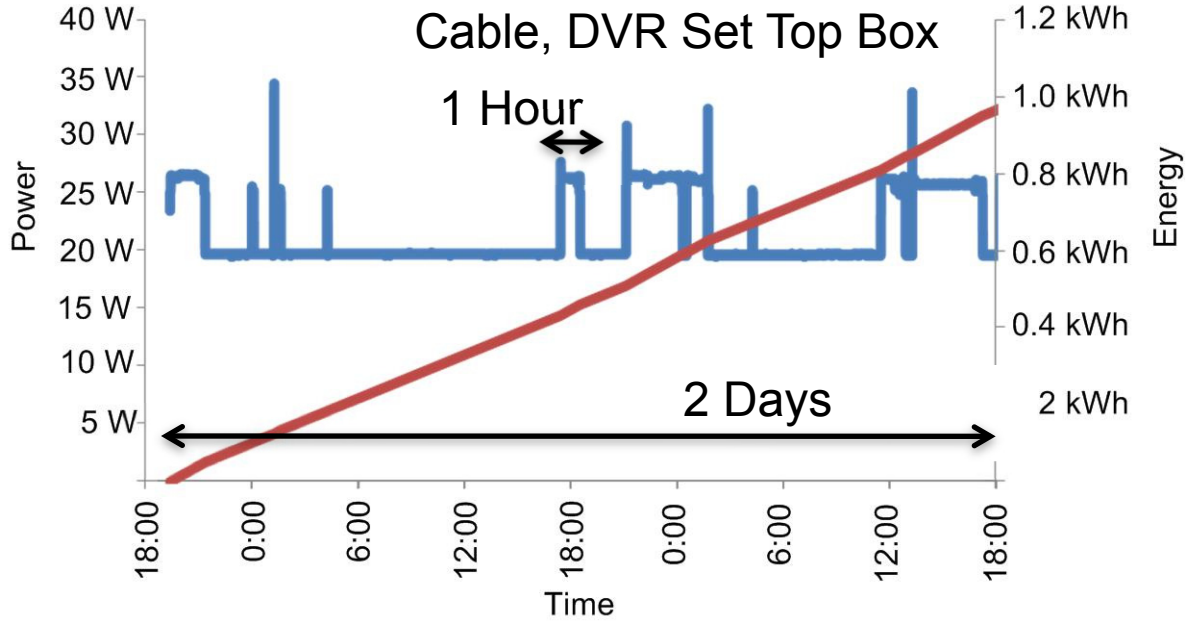
Our 5-Year Plan

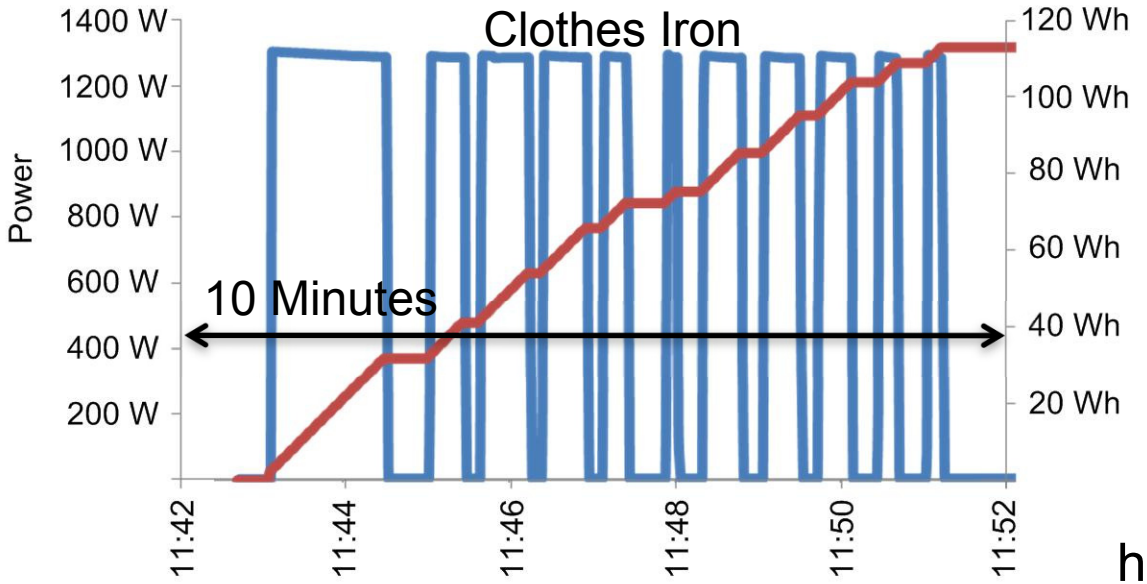
- Reduce MELs energy use by
  - Guiding product design
  - Developing technology
  - Informing consumers
- Intermediate goals include
  - Deriving usage patterns
  - Testing control & technology strategies
  - Guiding policy & forecasting
  - Links to commercial buildings

Project Goals

1. Develop and test a **methodology** for field measurements of MELs
   - What are the practical problems associated with long-term metering of 50+ devices in a home?
   - Not estimating average US MEL energy use
2. Prepare a plan for full-scale MELs metering study

MELs in Action



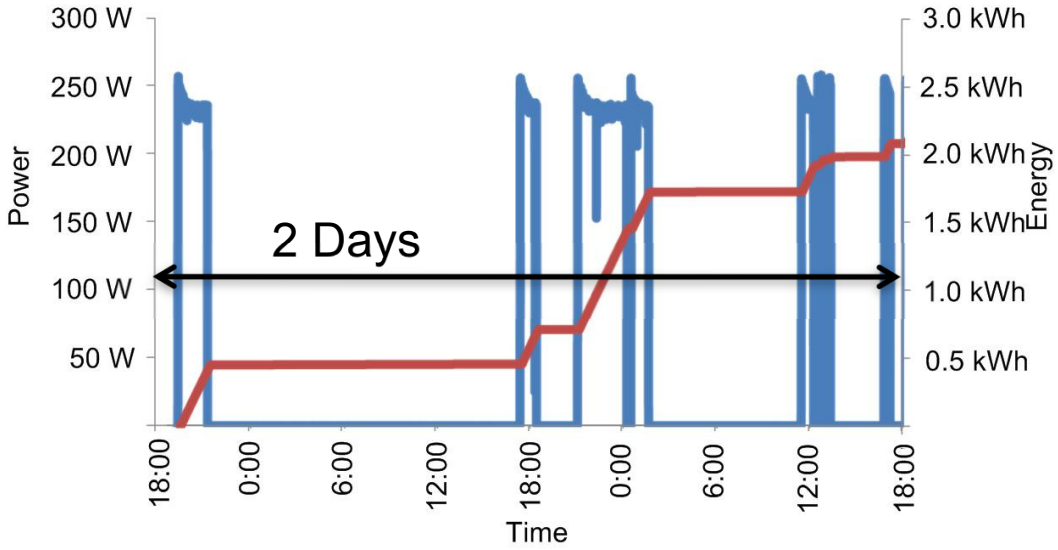


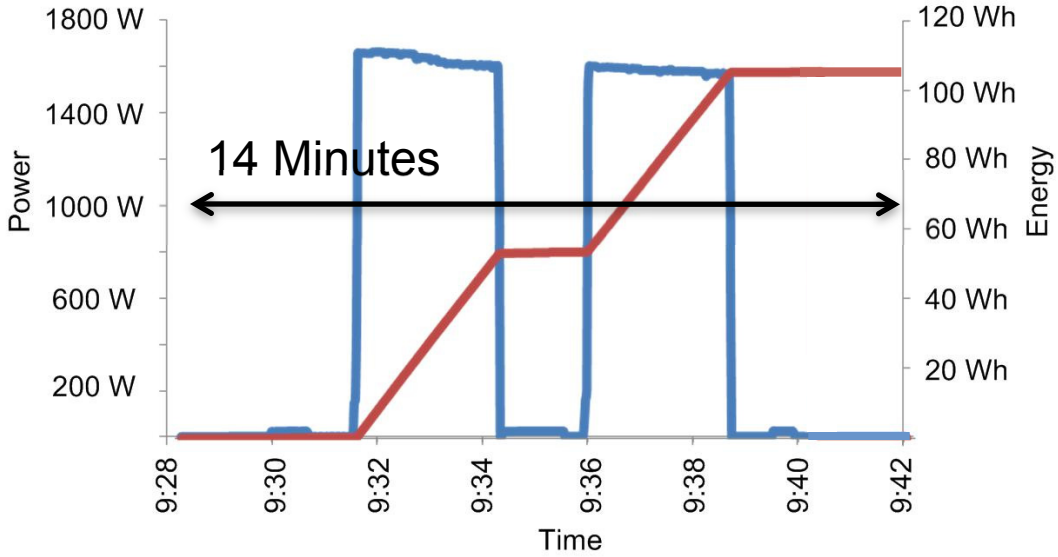
http://minotaur.lbl.gov/aeud/

MELs in Action

TV: Active >> Standby

Microwave: Standby and active energy similar





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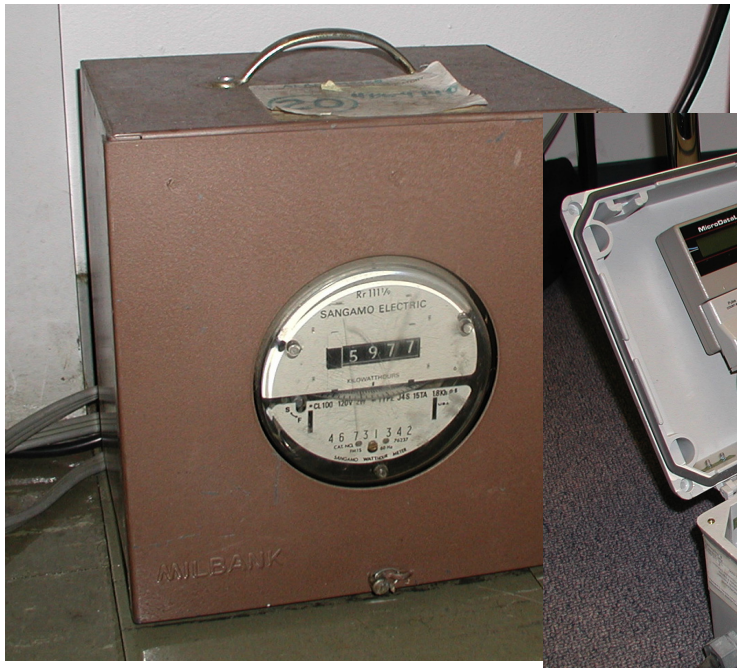
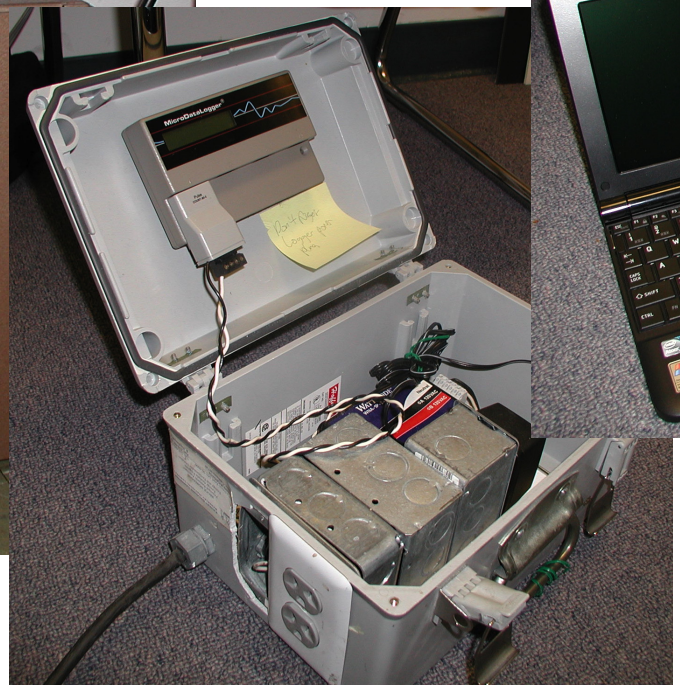
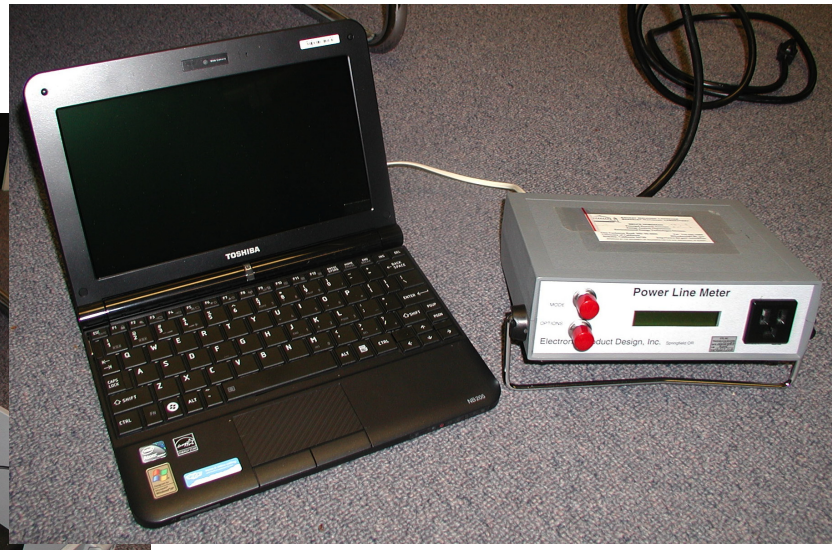
Evolution of MELs Metering



1980s:
Utility Meter In a Box
-Energy only
-Manual read



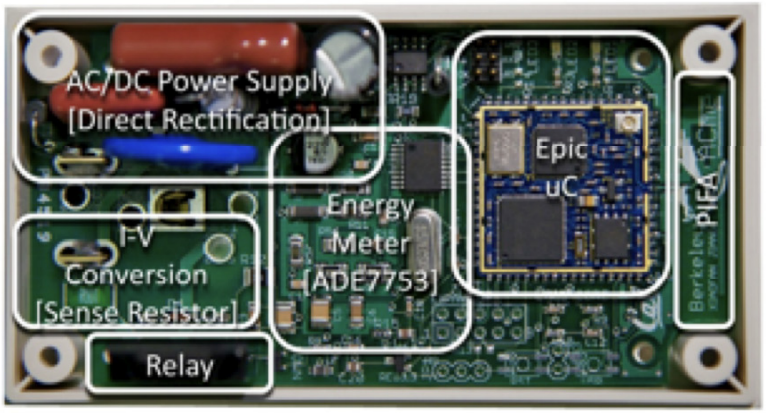
1995:
Meter In a Box
-Pulse per 0.5 Wh
-Logged automatically

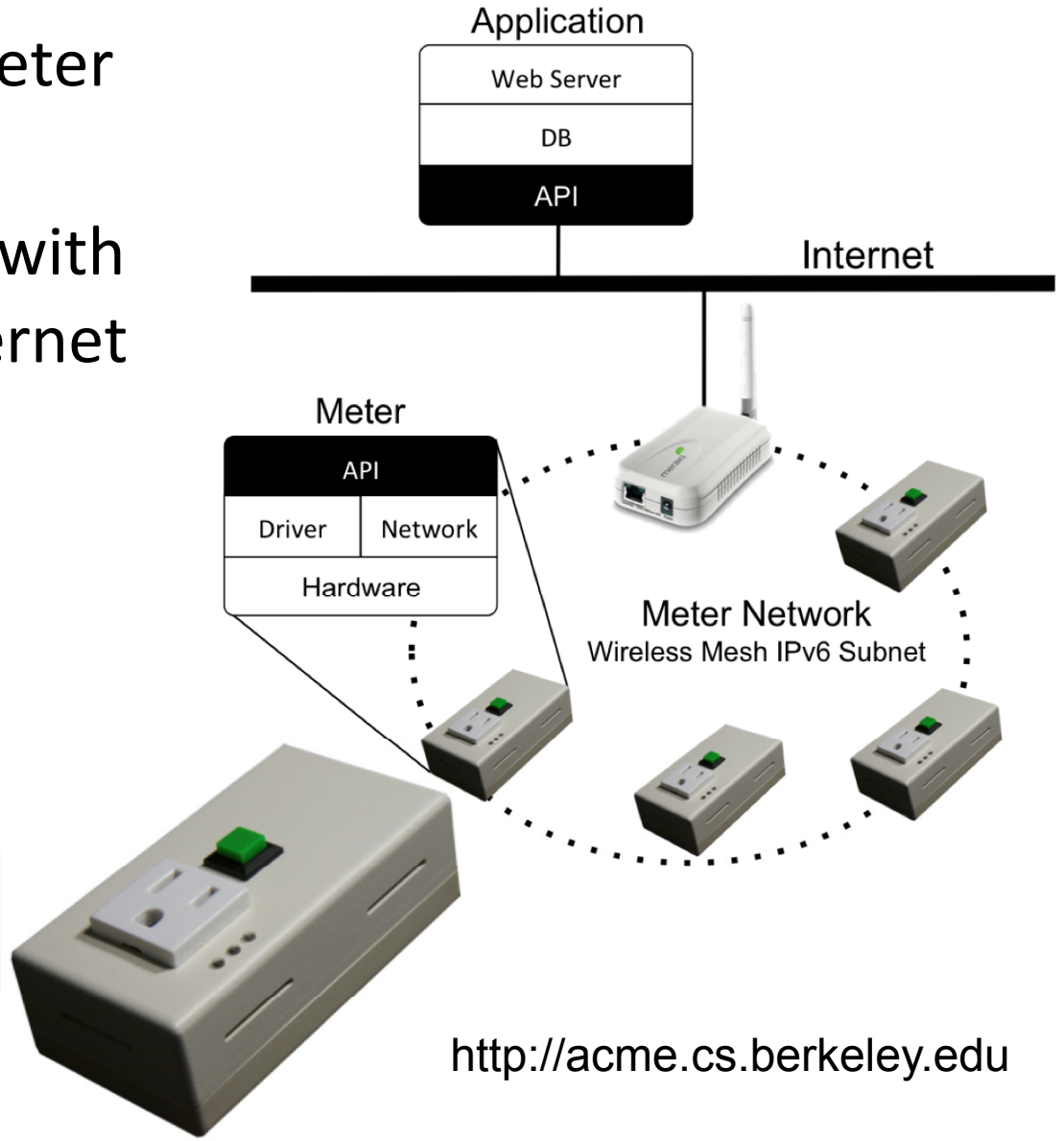


2000:
Power Line Meter
-Logs to laptop
-0.01 W accuracy
-2 s update

LBNL MEL metering

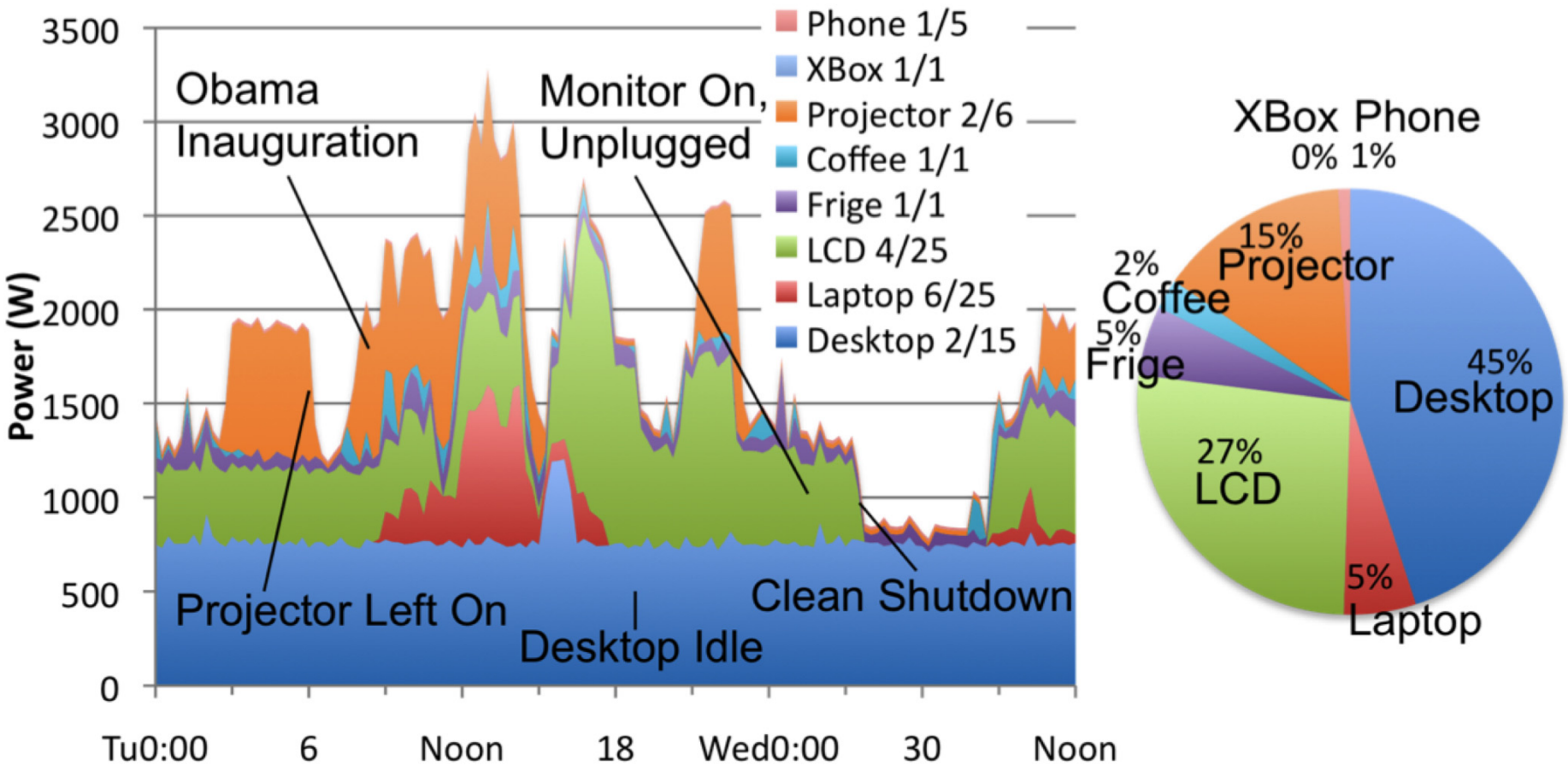
- Wireless power meter for each device
- Mesh networking with backhaul over internet
- Real power with accuracy of 0.1W





http://acme.cs.berkeley.edu

MELs metering @ UC Berkeley



X. Jiang, S. Dawson-Haggerty, P. Dutta, D. Culler, “Design and Implementation of a High Fidelity AC Metering Network”, IPSN 2009.

What to Call Things?

- Taxonomy of Devices
  - Consistent naming
  - Unambiguous categorization
  - Technology changes (a CRT TV is not a LCD TV)
  - New devices through convergence
- Taxonomy of Modes
  - Sleep vs Standby
  - Devices with several modes?

Links to Other LBNL Activities

- Commercial MELs

- Building America

- Energy Star

- Standby power research and monitoring
- International Energy Agency (IA4E)

Related Research

- France & Sweden (Siedler)
- Australia & New Zealand (HEEP)
- Japan
- TIAX
- Ecos
- FSEC
- Utility studies (WI)

Questions for Discussion

- What products fall into MELs and not in conventional end uses?
  - water heater at tap, desk lamp, ventilation fan, de-humidifier, portable heater, wine cooler
- How do we name products that have several functions ("clock-radio", microwave oven, computer display-TV, etc.)?
- How long should they be metered?
- How much associated characteristics data to collect?
- Do we meter the product or the outlet?
- How do we capture irons, vacuum cleaners, and other devices plugged in occasionally?
- Special strategy for pet-related energy use? (aquariums, kitty-litter box cleaners)
- How do we collect hard-wired products?
  - GFCIs, smoke alarms, driveway heater, pool pump
- Will a "typical" family consent to such an intrusion?
- How to deal with appliance acquisitions/discards during metering period?
- Collect additional data like occupancy, light levels?
- Do we try to meter everything?
- What about non-electric loads?

- and many more…